

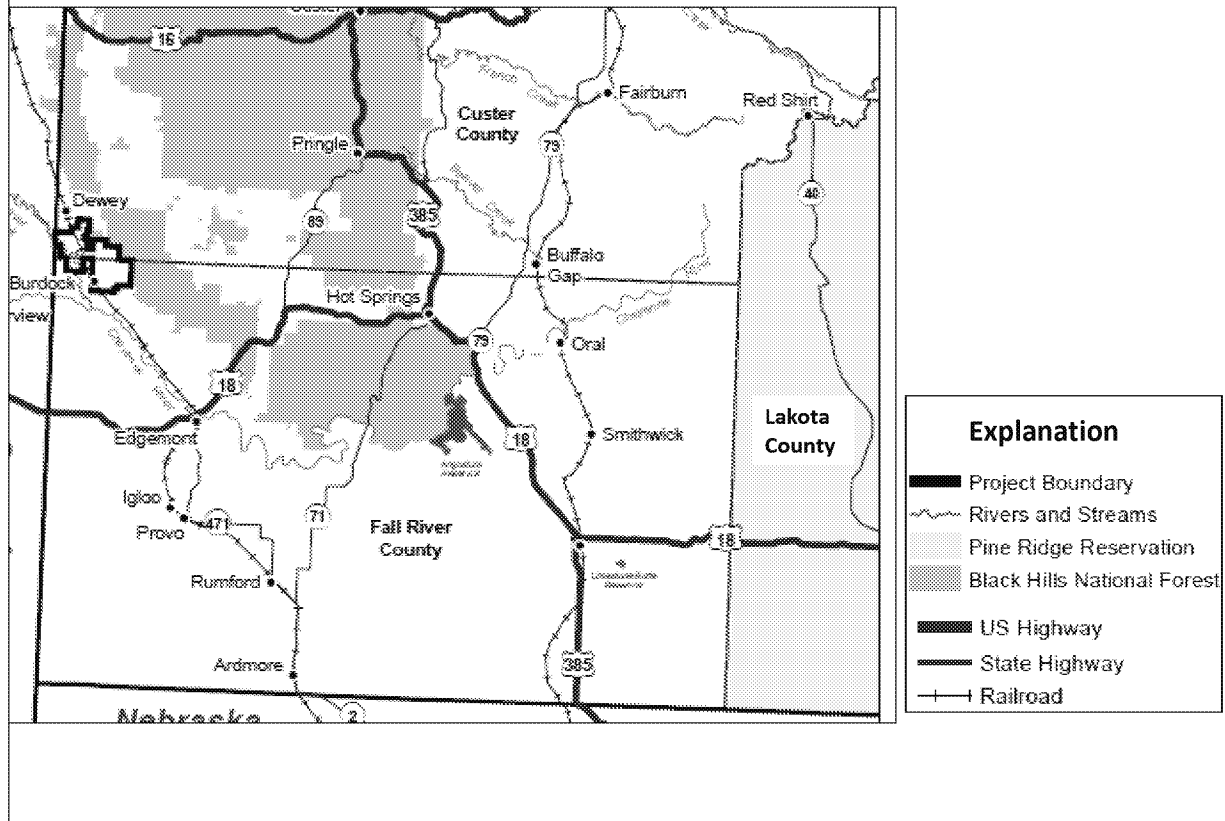


**U.S. Environmental Protection Agency
Region 8 Office, Denver, CO
Underground Injection Control Program**

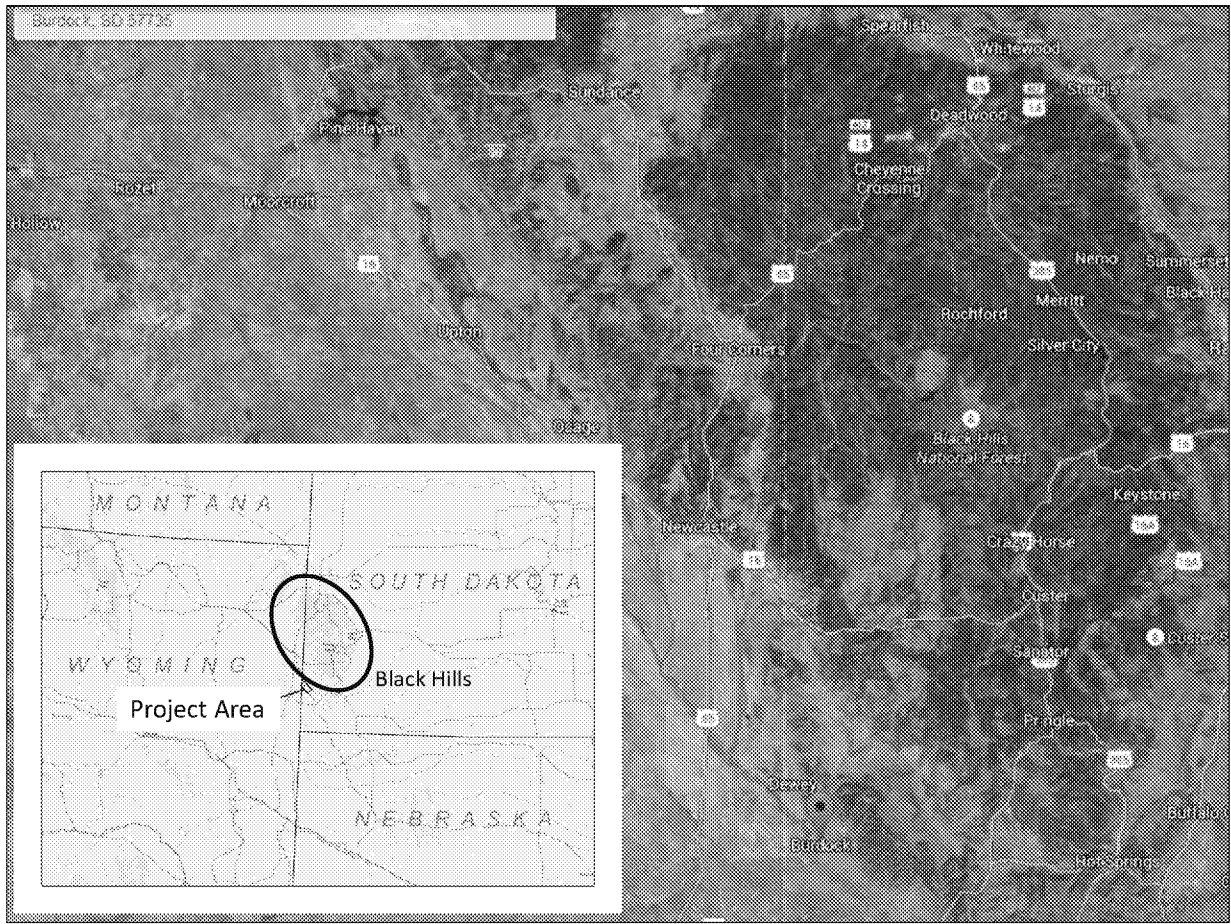
***EPA Proposed Permitting
and Aquifer Exemption Actions
at the Dewey-Burdock Uranium Recovery Site***

**Oglala Sioux Tribe/EPA Meeting
August 28, 2020**

Dewey-Burdock Location Map



The Dewey Burdock site is located in the SW corner of Custer County and the NW corner of Fall River County on the Wyoming/South Dakota border. In the southern Black Hills. About 45 miles west of the Pine Ridge Reservation. Very close to Cheyenne River which is a concern for Oglala Sioux and Cheyenne River Sioux Tribes since the Cheyenne River borders their reservations.



**The EPA Region 8 UIC Program
received permit applications
for two types of injection wells**

1. **A Class III Permit Application for the injection of
lixiviant to mobilize uranium in the ore bodies within
Inyan Kara aquifers. (lixiviant is Inyan Kara groundwater
with oxygen and carbon dioxide added)**
2. **A Class V Permit Application for the disposal of
treated ISR waste fluids into deep wells
completed in the Minnelusa aquifer (only if
Minnelusa groundwater is NOT an underground source of
drinking water).**

EPA UIC Permitting Authority

The UIC Program is authorized under the
Safe Drinking Water Act

to protect

Underground Sources of Drinking Water
from contamination resulting from injection activities.

Underground source of drinking water (USDW) means
an aquifer or part of an aquifer which either

- supplies drinking water for human consumption or
 - contains a sufficient quantity of groundwater to supply a public water system
- and
- contains fewer than 10,000 mg/l total dissolved solids.

Other Regulatory Agencies at the Dewey-Burdock Site

- The Nuclear Regulatory Commission issued a radioactive materials license for the entire site.
- The South Dakota Department of Environment and Natural Resources proposed issuance of a Large Mine Permit for the entire site.
- The BLM proposed a Plan of Operations for 13 acres of BLM land within the site boundary.
- The South Dakota Department of Environment and Natural Resources has proposed issuance of a groundwater discharge permit for the land application of treated ISR waste fluids.

EPA UIC Permitting Authority

UIC Regulations specify permit requirements for injection well construction, operation, monitoring and well closure.

40 CFR 144 Subpart E—Permit Conditions

§144.51 Conditions applicable to all permits.

§144.52 Establishing permit conditions.

(a)(9) *Additional conditions.* The Director shall impose on a case-by-case basis such additional conditions as are necessary to prevent the migration of fluids into underground sources of drinking water.

UIC Regulations and the UIC Permits

- UIC regulations require the permittee to conduct considerable testing to provide EPA hydrogeological and other data before any injection wells are authorized to operate.
- The data must demonstrate vertical confinement to prevent movement of fluids out of the injection zone so that no USDWs are contaminated.
- The data must also demonstrate that it is possible to contain the Class III injection interval fluids horizontally to prevent contaminant migration into USDWs.
- Minnelusa water quality data must demonstrate the injection zone is *NOT* a USDW, or EPA will not issue authorization to inject.

The UIC Permit Violations...

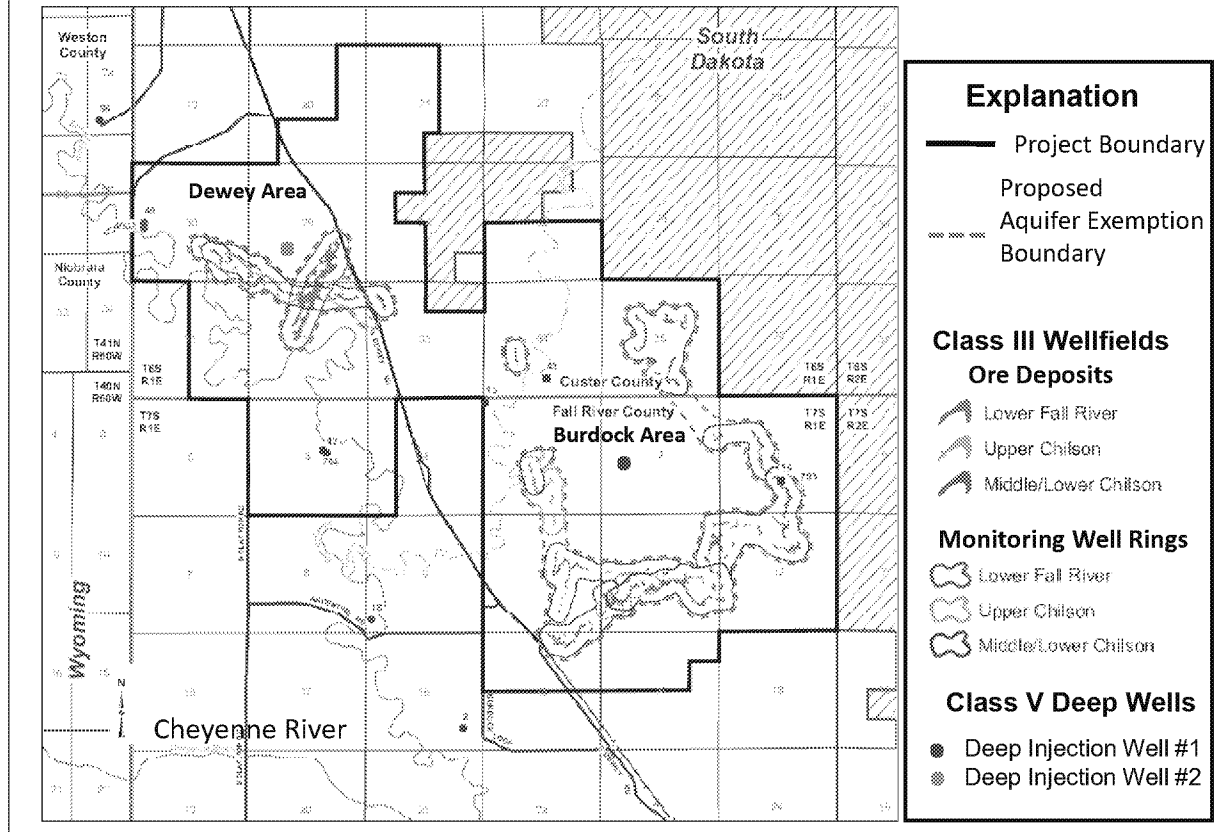
Identifies a number of permit violations:

- Failure to demonstrate well mechanical integrity
- Loss of injection well mechanical integrity
- Lack of compliance with monitoring and reporting requirements
- Migration of ISR contaminants into USDWs

The Safe Drinking Water Act...

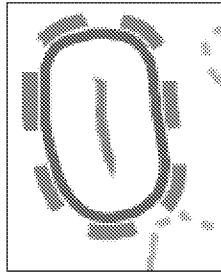
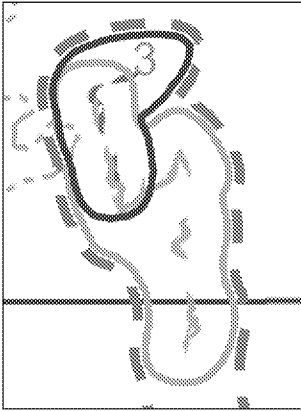
- Section 1423 authorizes EPA to take enforcement actions when UIC regulations and/or permit conditions are violated.
- Enforcement actions can include requirements for groundwater remediation activities, if appropriate.

Dewey-Burdock Proposed Injection Well Locations



Point out
SD WY Border
Custer and Fall River Counties
Dewey Area & Burdock Area
4 proposed wellfields in Dewey Area & 10 proposed wellfields in the Burdock Area.

Horizontal and Vertical Views of Ore Deposits



Legend

- Project Boundary
- Proposed Aquifer Exemption Boundary

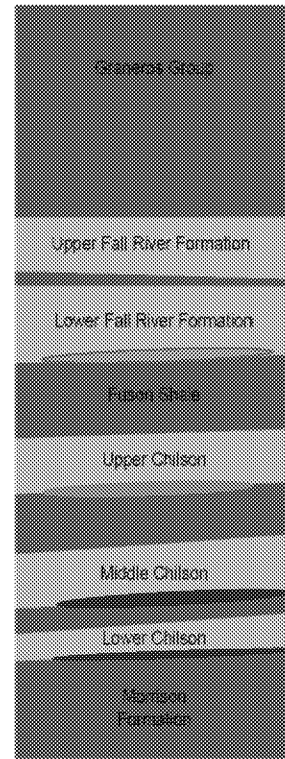
Ore Deposits

- Lower Fall River
- Upper Chilson
- Middle/Lower Chilson

Perimeter Monitoring Well Ring Locations

- Lower Fall River
- Upper Chilson
- Middle/Lower Chilson

Inyan
Kara
Group



Local
confining
units

Shovel Creek Shale

Full River

Laramie

Carbonate

Madison

Pineau Creek Shale

Upper Madison

Middle Madison

Lower Madison

Utah

Madison

UIC Well Classifications

40 CFR §144.6 Classification of wells.

Injection wells are classified as follows:

(a) Class I. Includes Radioactive waste disposal wells which inject fluids below the lowermost formation containing an underground source of drinking water

(e) Class V. Injection wells not included in the other wells classes.

Class V wells cannot be radioactive waste disposal wells, so that is why the proposed Class V Area Permit requires treatment of injectate to radioactive waste standards.

(c) Class III. Wells which inject for extraction of minerals including:

In situ production of uranium or other metals

EPA UIC Permitting Authority

40 CFR PART 146—UNDERGROUND INJECTION CONTROL PROGRAM: CRITERIA AND STANDARDS

Subpart B - Criteria and Standards Applicable to Class I Wells

§ 146.11 Criteria and standards applicable to Class I nonhazardous wells.

§ 146.12 Construction requirements.

§ 146.13 Operating, monitoring and reporting requirements.

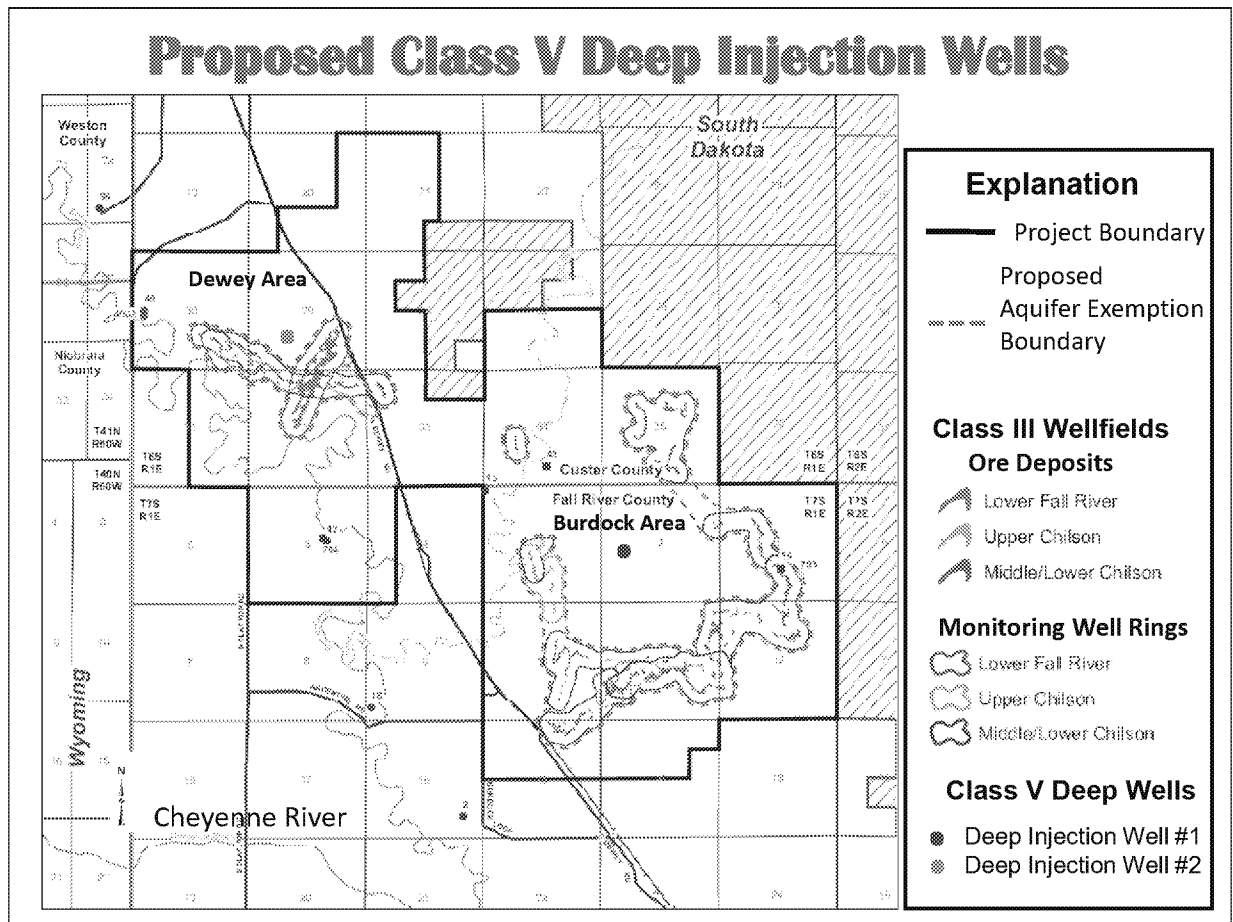
§ 146.14 Information to be considered by the Director.

Subpart D—Criteria and Standards Applicable to Class III Wells

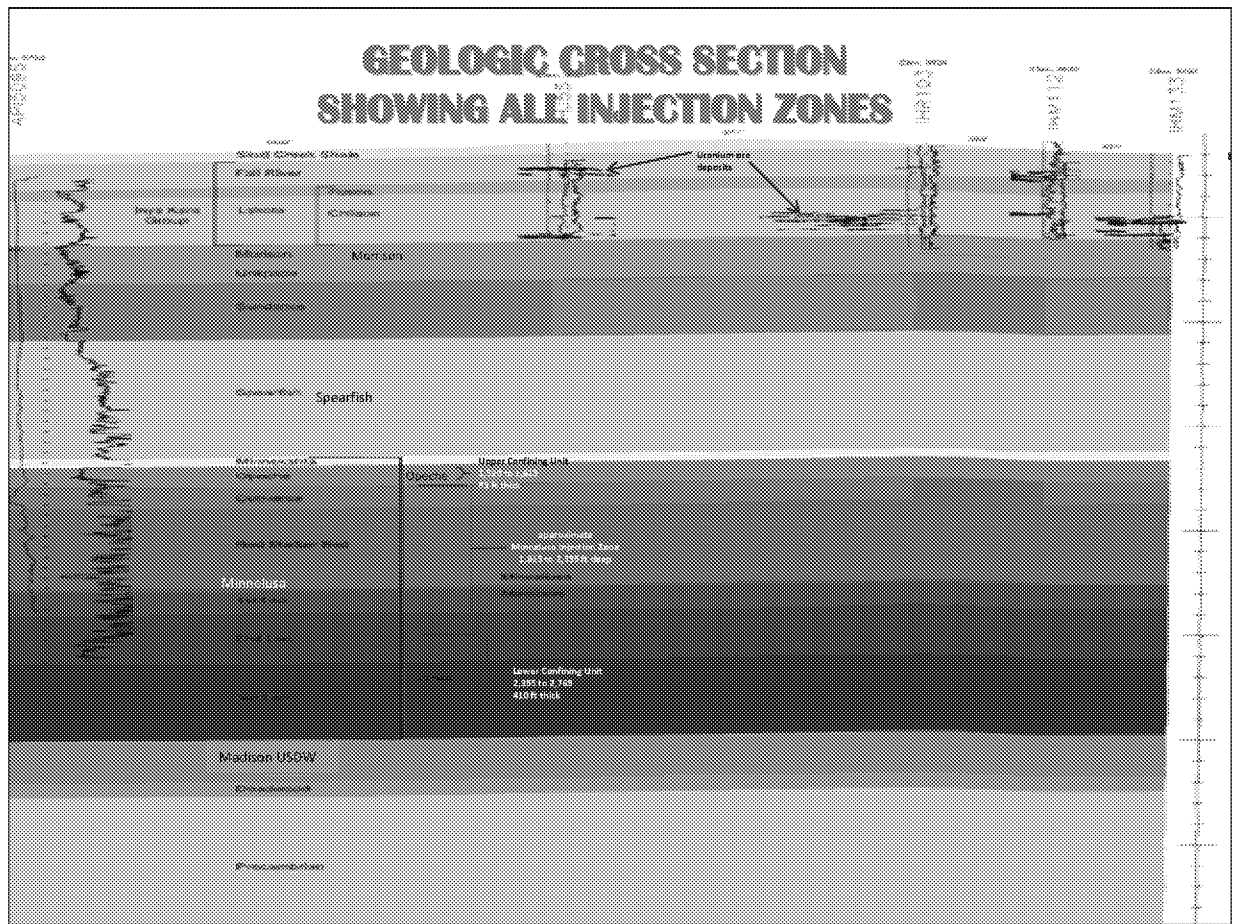
§ 146.32 Construction requirements.

§ 146.33 Operating, monitoring, and reporting requirements.

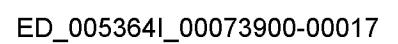
§ 146.34 Information to be considered by the Director.

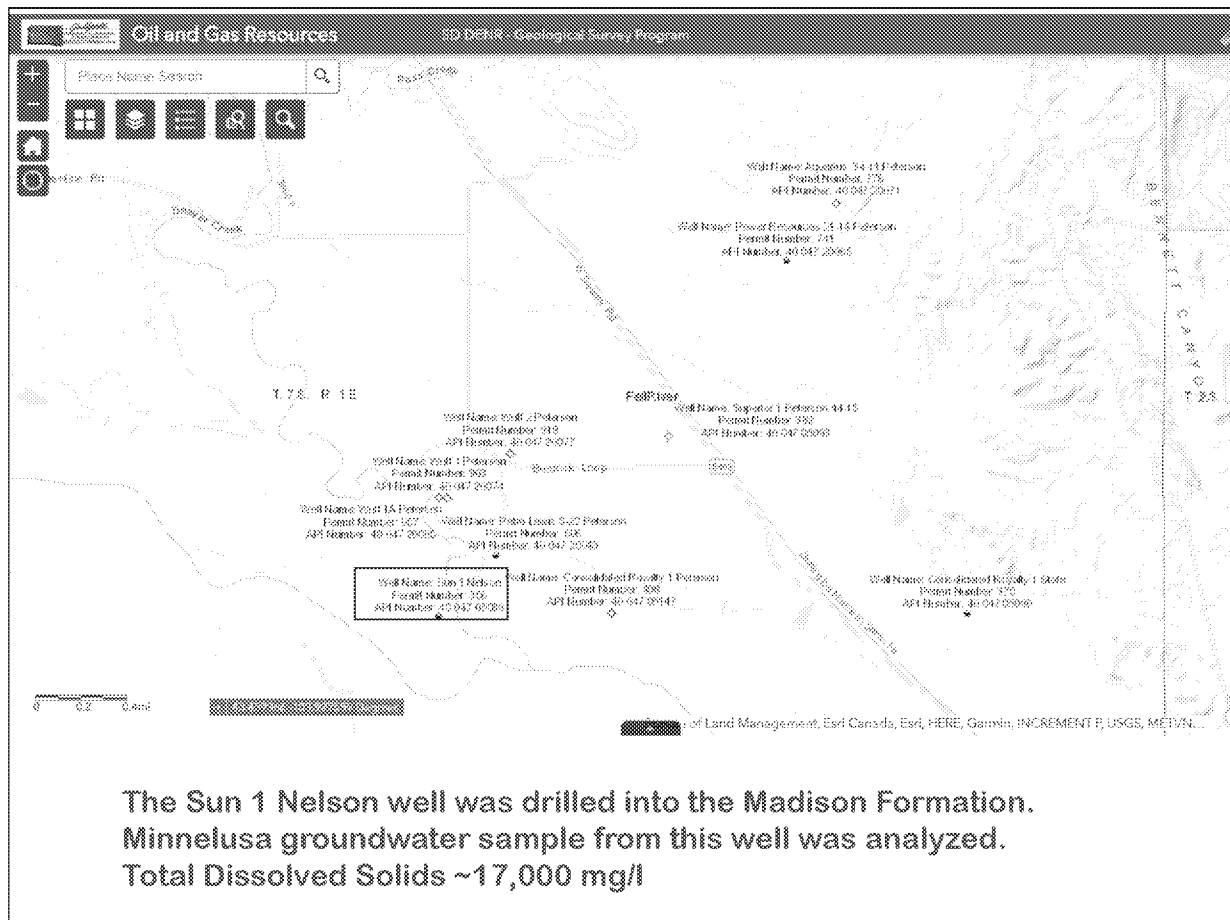


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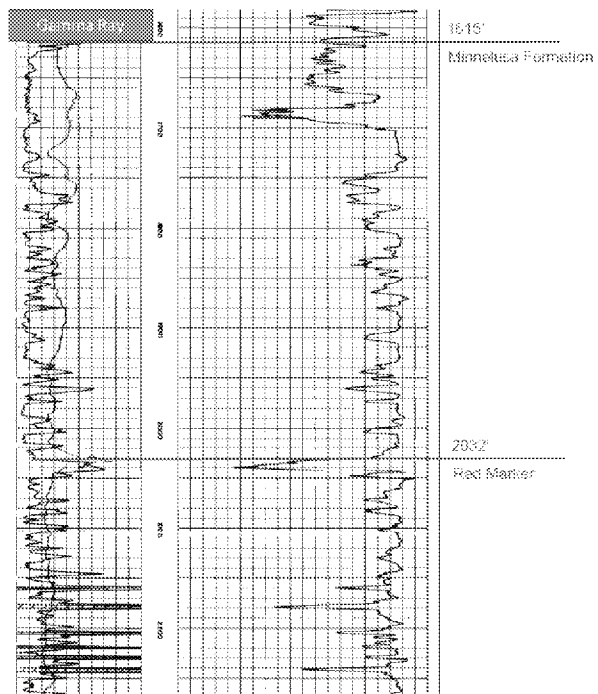


This stratigraphic cross section of the geologic formations present at the Dewey Burdock Site shows the proposed injection zones in the Inyan Kara (green layer near the top) and in the Minnelusa (the blue layers in the middle). Note the thick confining zone (dark blue layer) between the base of the Minnelusa injection zone and the Madison USDW. This confining zone will isolate the Class V deep well injectate from the Madison Formation aquifer. Class V draft permit requirements will provide data to confirm this isolation between the two aquifers.

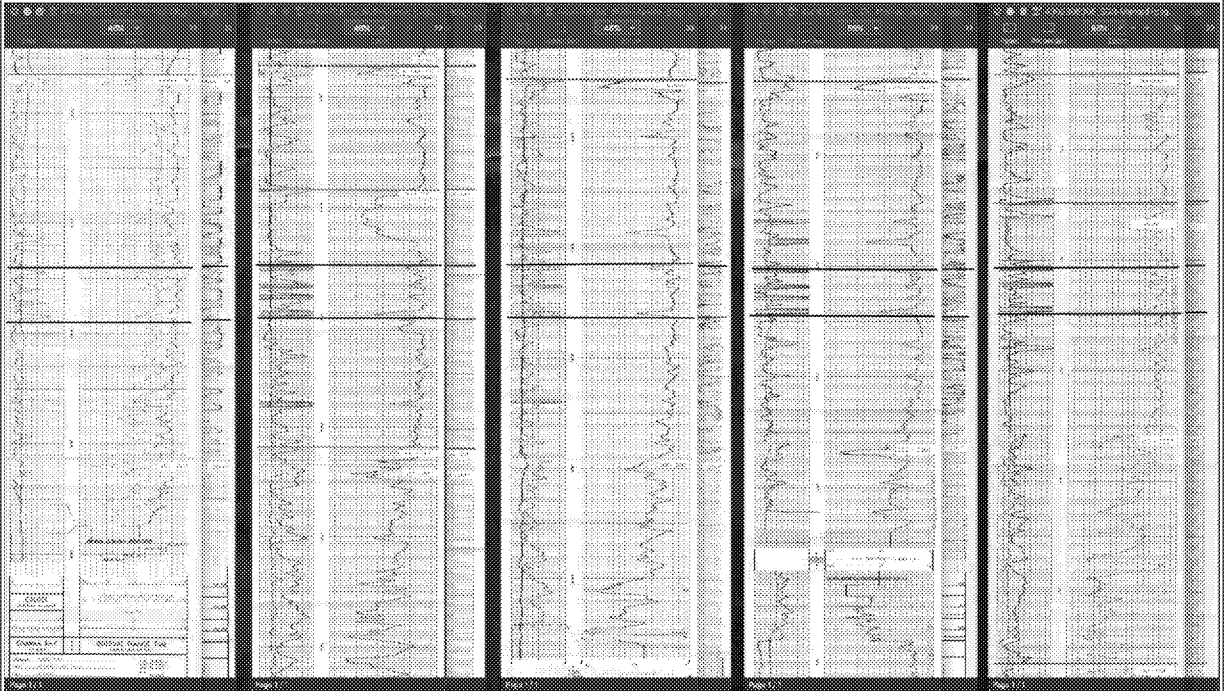


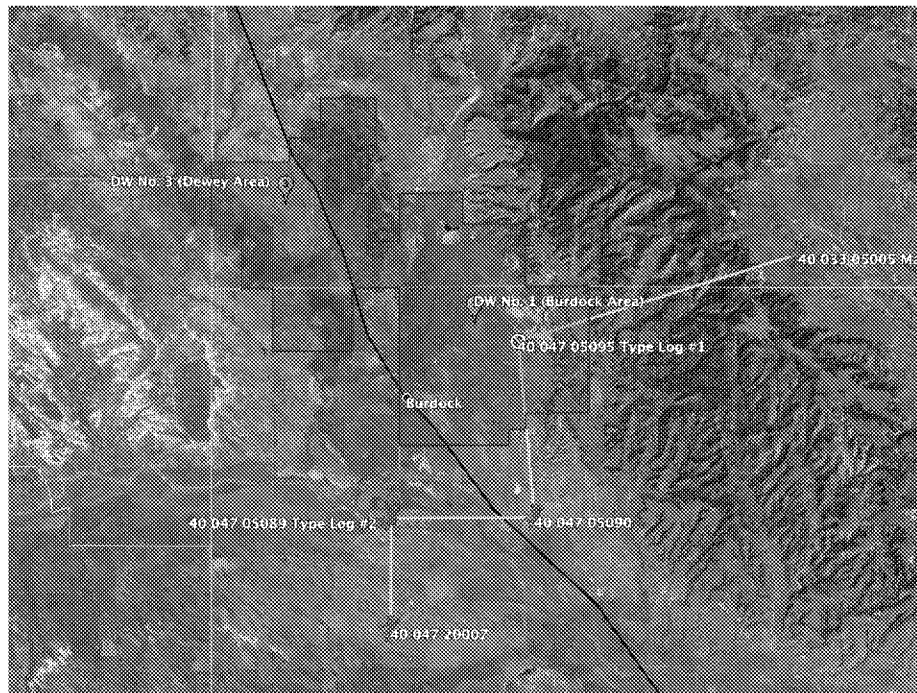


Radioactive shales



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Go to the South Dakota Stratigraphic Correlation Chart

<http://www.sdgs.usd.edu/pubs/pdf/OGI-03.pdf>

There has been quite a bit of investigation on the Minnelusa Formation and correlation of the geologic units that occur within it across the areas around Dewey-Burdock.

Dewey Burdock Proposed Class III UIC Wellfields

Explanation

- Project Boundary
- Proposed Aquifer Exemption Boundary

Class III Wellfields Ore Deposits

- Lower Fall River
- Upper Chilson
- Middle/Lower Chilson

Monitoring Well Rings

- Lower Fall River
- Upper Chilson
- Middle/Lower Chilson

Class V Deep Wells

- Deep Injection Well #1
- Deep Injection Well #2

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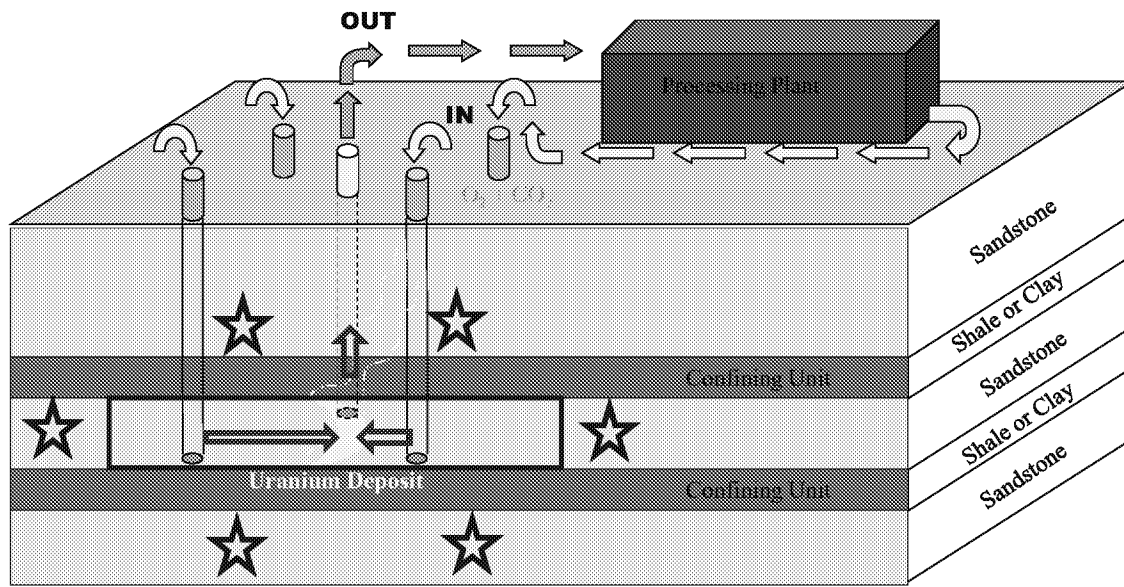
Process for In-Situ Recovery Uranium

- Class III Injection wells inject "lixiviant"
- Lixiviant would be composed of Inyan Kara groundwater with oxygen and carbon dioxide added.
- The uranium will be extracted from the ore deposit using injection wells.
- The uranium-bearing solution will be pumped to the surface using extraction wells.



Example of an In-situ Uranium Recovery Wellfield in WY

Uranium In-Situ Recovery Process



Typical five-spot pattern. In three dimensions, the wells follow the uranium deposit. Could be at different depths. Blue box represents aquifer exemption boundary – this boundary outlines an aquifer that currently does not meet U.S. drinking water standards.

Goal with restoration process after mining is to get this zone back to baseline water quality.

Stars represent monitoring wells where we do not want to see any change in water quality.

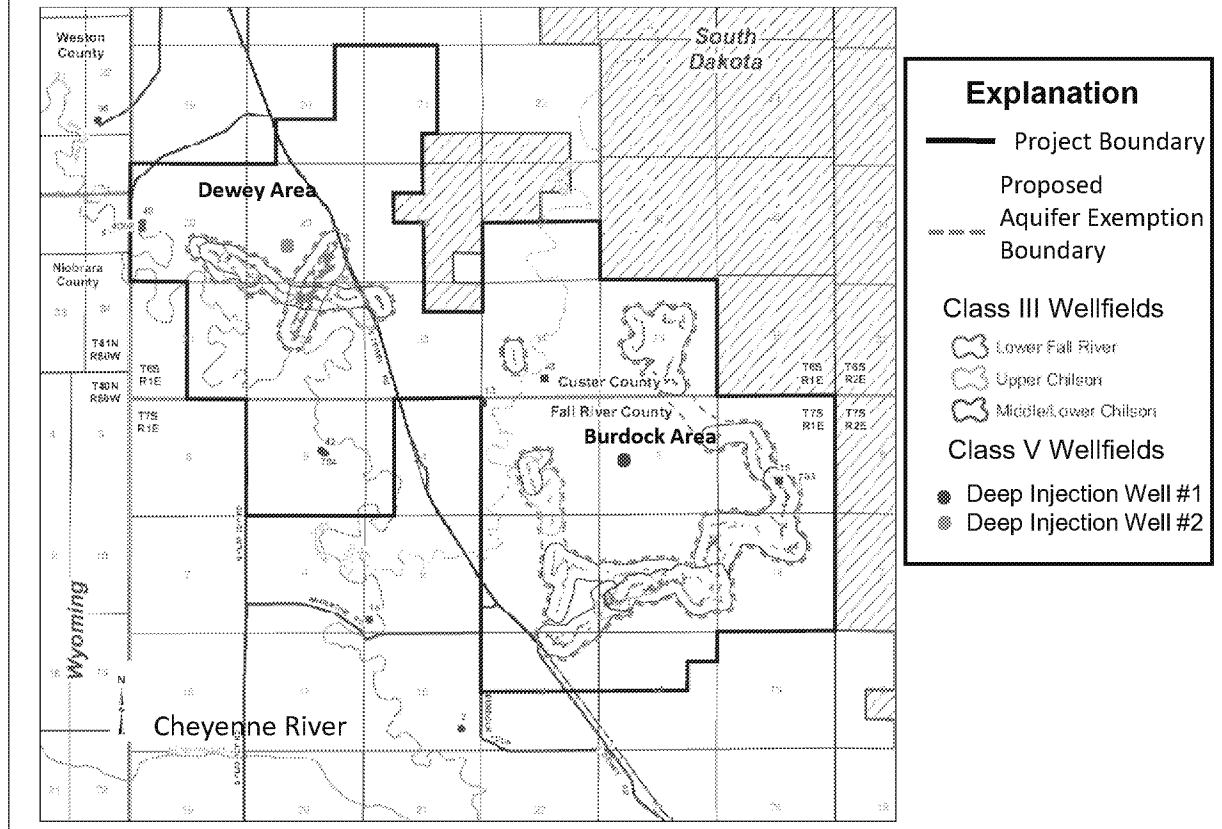
The EPA has proposed exemption of ore-bearing areas in Inyan Kara aquifers

An Aquifer Exemption is required to inject into the Class III wells for uranium recovery.

An Aquifer Exemption is allowed under UIC regulations IF the USDW

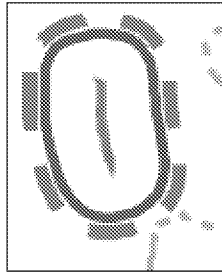
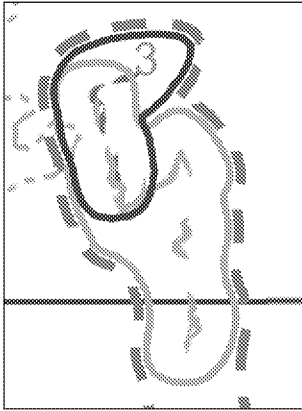
1. Does not currently serve as a source of drinking water and
2. Is mineral producing or can be demonstrated to contain commercially producible minerals.

Horizontal extent of proposed AE area



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Vertical extent of proposed AE Area



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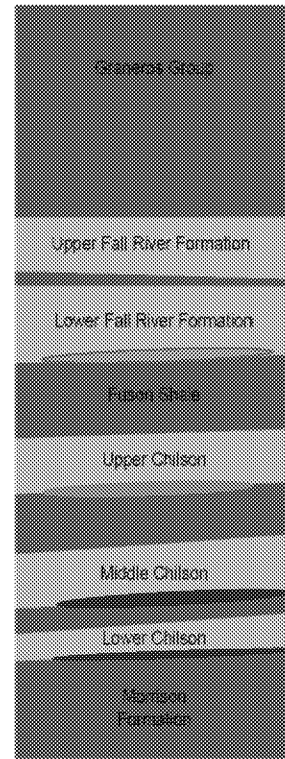
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Inyan
Kara
Group

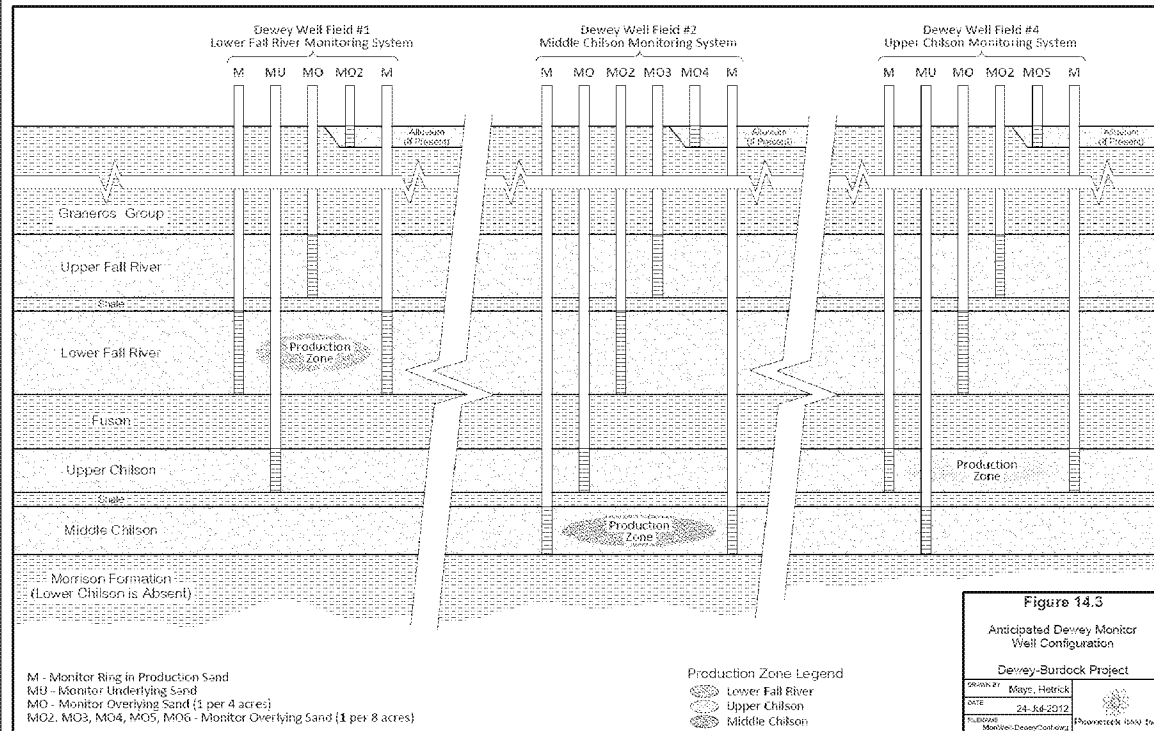


Local
confining
units

The Proposed Class III Area Permit

- Requires protection of USDWs around the AE area through extensive monitoring.
 - Excursion monitoring
 - More frequent monitoring of a confirmed excursion.
 - Geochemical modeling of an “expanding excursion plume.”
- Requires the permittee to demonstrate that elevated concentrations of ISR contaminants remaining in the wellfield injection zone after groundwater restoration will not cross the AE boundary.

Excursion Monitoring Wells



EPA UIC Permitting Authority

§ 146.10 Plugging and abandoning injection wells.

(a) Requirements for Class I, II and III wells.

(1) Prior to abandoning Class I, II and III wells, the well shall be plugged ... a manner which will not allow the movement of fluids either into or between underground sources of drinking water.

...

(4) The plugging and abandonment plan ... shall, in the case of a Class III project which underlies or is in an aquifer which has been exempted under §146.04, also demonstrate adequate protection of USDWs. The Director shall prescribe aquifer cleanup and monitoring where he deems it necessary and feasible to insure adequate protection of USDWs.

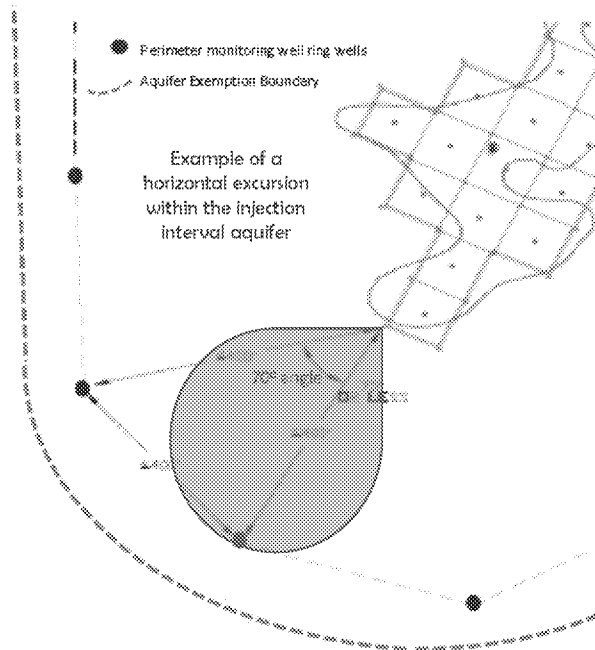
Excursion Monitoring

Excursion indicator parameters are more mobile constituents of the lixiviant that move faster through the injection interval aquifer than the other constituents. The proposed excursion indicators are alkalinity, conductivity and chloride.

When the excursion indicators move out of the wellfield injection interval area and are detected at a perimeter monitoring well, the event is called an "excursion."

If an excursion is detected at a perimeter monitoring well, the monitoring frequency of the impacted well is increased to every week until the excursion plume is removed.

The Class III permit requires that the wells impacted by the excursion and the monitoring wells the nearest impacted monitoring wells are also sampled every week in order to determine early that an excursion plume may be expanding. This requirement is new to the industry.



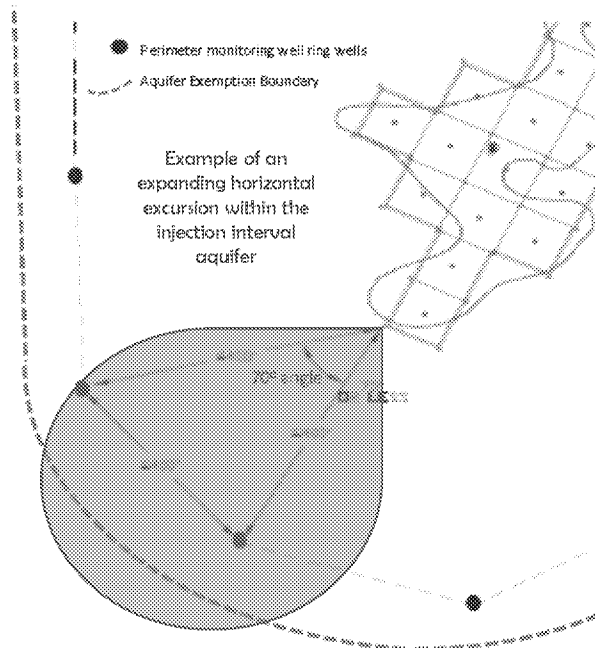
Expanding Excursion Plume

The draft Class III Area Permit defines an “expanding” excursion plume based on additional monitoring wells being impacted or increasing concentrations of the excursion indicators.

The permittee must monitor for the other ISR contaminants in the impacted monitoring well. If the other ISR contaminants are detected in the excursion monitoring wells, the Permittee must develop a geochemical model to estimate where the front of the excursion plume is located.

After reviewing the model results, the Director will determine what actions the Permittee should take to protect USDWs, including the installation of additional monitoring wells and aquifer remediation, if needed.

If ISR contaminants cross the aquifer exemption boundary into the USDW, that is a violation of the Class III permit and the permittee would be required to conduct aquifer remediation of the USDW.



These “expanding plume” excursion monitoring requirements are new to the ISR industry. The down-gradient monitoring wells are required to verify that contaminants are not moving across the aquifer exemption boundary into the USDW.

Next Topic: Environmental Justice